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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/799,905	03/12/2004	Thomas J. O'Keefe	31550-1001	8305
5179 7590 09/05/2008 PEACOCK MYERS, P.C. 201 THIRD STREET, N.W. SUITE 1340 ALBUQUERQUE, NM 87102				
EXAMINER				
LEADER, WILLIAM T				
ART UNIT		PAPER NUMBER		
1795				
MAIL DATE		DELIVERY MODE		
09/05/2008		PAPER		

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

### Office Action Summary

**Application No.**

10/799,905

**Applicant(s)**

O'KEEFE ET AL.

**Examiner**

WILLIAM T. LEADER

**Art Unit**

1795

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 25 April 2008.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-6, 9-11, 13-19, 27, 39, 42, 44 and 47-52 is/are pending in the application.

4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.

- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.

- 6) ☒ Claim(s) 1-6, 9-11, 13-19, 27, 39, 42, 44 and 47-52 is/are rejected.

- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.

- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Continued Examination Under 37 CFR 1.114*

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on April 25, 2008 has been entered.
2. New claims 50-52 have been added. Claims 1-6, 9-11, 13-19, 27, 39, 42, 44 and 47-52 are pending.

### *Claim Rejections - 35 USC § 112*

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1-6, 9-11, 13-19, 27, 39, 42, 44 and 47-52 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Claim 2 recites that the substrate comprises at least one material selected from the group consisting of a metal, metal alloy and a metal-containing compound. Since a dependent claim must further limit the claim from which it depends, claim 1 must be broader than claim 2 and must include

substrates which are not a metal, metal alloy or metal-containing compound. The substrates described in the specification fall within the scope of claim 2. The specification is not considered to be enabling for substrates other than the materials recited in claim 2. As explained in the MPEP at 2164.01,

Any analysis of whether a particular claim is supported by the disclosure in an application requires a determination of whether that disclosure, when filed, contained sufficient information regarding the subject matter of the claims as to enable one skilled in the pertinent art to make and use the claimed invention. The standard for determining whether the specification meets the enablement requirement was cast in the Supreme Court decision of *Mineral Separation v. Hyde*, 242 U.S. 261, 270 (1916) which postured the question: is the experimentation needed to practice the invention undue or unreasonable? That standard is still the one to be applied. In *re Wands*, 858 F.2d 731, 737, 8 USPQ2d 1400, 1404 (Fed. Cir. 1988). Accordingly, even though the statute does not use the term "undue experimentation," it has been interpreted to require that the claimed invention be enabled so that any person skilled in the art can make and use the invention without undue experimentation. In *re Wands*, 858 F.2d at 737, 8 USPQ2d at 1404 (Fed. Cir. 1988).

In this instance, claim 1 includes within its scope an active substrate made of an organic compound such as a plastic. Applicant has provided no guidance as to how it is determined whether such compounds are more or less noble than a deposition component, such as a metal, to be deposited. Such a determination would involve undue experimentation.

Claim 4 recites that the deposition component comprises at least one material selected from the group consisting of a metal, a metal alloy, a metal compound, a metal ion and an organometallic complex. Since a dependent claim must further limit the claim from which it depends, claim 1 must be broader than claim 4 and must include deposition components which are not a metal, a metal alloy, a metal compound, a metal ion or an organometallic complex. The deposition components described in the specification fall within the scope of claim 4. The specification is not considered to be enabling for deposition components other than the materials recited in claim 4. Claim 1 includes a deposition component made of an organic compound such as a plastic. Applicant has provided no guidance as to how it is determined whether such compounds are more or less noble than an active substrate, such as a metal, on which deposition it to occur. Such a determination would involve undue experimentation.

4. Claim 39 recites that the step of depositing comprises using two galvanic-half-cell reactions.

Claim 47 recites that the step of depositing comprises reducing the deposition component at a cathodic site by an electrochemical reaction. Since a dependent claim must further limit the claim from which it depends, claim 1 must be broader than claim 39 and must include a deposition mechanism other than those which can be described by two galvanic half-cell reactions; and claim 1 must be broader than claim 47 and include a deposition mechanism other than reducing the deposition component at a cathodic site. Page 6, line 15 of the specification indicates that the present invention uses galvanic coating and a displacement reaction. As explained at page 14 of the specification the less noble constituent serves as a reducing agent for the more noble constituent which is reduced. As indicated at page 15, lines 1-3 of the specification, the oxidation and reduction can each be written as a half-cell reaction. The specification is not considered to be enabling for depositions other than those which involve the oxidation of a less noble active substrate by a more noble deposition component and the simultaneous reduction of the more noble deposition component by the less noble active substrate. Deposition which involves oxidation and reduction may be written as two half-cell reactions.

5. Claims 50 and 52 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

6. Newly presented claim 50 recites the step of removing a barrier layer. Basis for this newly added claim in the specification is not apparent. Page 12, lines 1-3 indicate that a surface coating such as oxides of a barrier layer may be removed, but this portion of the specification does not appear to provide basis for the step of claim 50 as worded. This is a new matter rejection.

7. Newly presented claim 52 recites a "further" step comprising "sensitizing" the active substrate for further depositing of the desired deposition component. Basis for this newly added limitation in the specification is not apparent. The only pre-treatment of the substrate appears to be the discussion of a "pre-treatment/pre-etching" step at pages 17-18 of the specification. There appears to be no discussion of "sensitizing". This is a new matter rejection.

8. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

9. Claims 1-6, 9-11, 13-19, 27, 39, 42, 44 and 47-52 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

10. Applicant's amendments to the claims have overcome a number of the issues identified with respect to 35 U.S.C. 112, second paragraph, in the previous office action. However, there are limitations which are considered to render the scope of the claims unclear.

11. Claim 1, lines 5 and 6 recite "a desired deposition component" which has a more noble composition than the less noble composition of the active substrate. Claim 1, line 7 recites the step of spontaneously displacing the active substrate with "a desired deposition component". It is not clear if the deposition component of claim 7 is the same deposition component as that recited in lines 5-6 which must be more noble than the substrate, or if it is a different desired deposition component. If it is applicant's

intent that the deposition component of line 7 is the same as that of lines 5-6, it is suggested that "a" be changed to ~~the~~—in line 7.

12. Claim 3, lines 1-2 refer to "the deposited or displacing deposition component". By using the expression "or", it appears that claim 3 includes the possibility that the deposited deposition component may be different from the displacing deposition component. As noted above, claim 1 recites the step of spontaneously displacing the active substrate with a desired deposition component. Claim 1 then recites the step of spontaneously depositing the desired deposition component from the organic solution onto the active substrate. Claim 1 as written appears to require the deposited deposition component be the same as the deposition component which has caused the displacement. Thus, there appears to be an inconsistency between claims 1 and 3. Since claim 1 is directed to a deposition method and a deposition step is positively recited, it is suggested that claim 3 should simply refer to the deposited deposition component and that "or displacing" should be deleted.

13. Claim 3, line 2 recites that the deposition component "further" comprises a seed composition. The use of the word "further" appears to indicate that the seed composition is in addition to something else. It is not apparent what the seed composition is in addition to. Note applicant's comment at page 10 of the Remarks, that atoms of the desired deposition component are deposited onto an active substrate and that these metal atoms then comprise a seed. Based on applicant's comments, it is the deposition component itself, which when deposited onto the active substrate at the beginning of the deposition process, that forms seeds.

14. Claim 49, line 2 recites that the organic solution comprises "most preferably" less than 0.25% water by volume. It is not apparent if the claim is limited to the numerical limitation 0.25, or if this is merely exemplary.

15. It remains unclear how it is determined whether the materials which are included within the scope of claim 1 are more or less noble. At page 12 of the Remarks, applicant lists the materials recited in

claims 5 and 11 and states that the website located at [www.corrosionsource.com](http://www.corrosionsource.com) provides data for these materials. The Examiner notes that claims 5 and 11 recite metals, and concurs that the web site provides data for metals. However, with the exception of graphite, all data in the graph at the web site is for metals and alloys. As explained in paragraphs 5 and 6 above, claim 1 is not limited to metals and alloys. Without some manner of determining how noble one material is relative to another, it is not clear how the scope of claim 1 can be determined.

#### *Claim Objections*

16. Claims 39, 42 and 47 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form.

17. Claim 39 recites the step of depositing comprises two galvanic half-cell reactions. Claim 47 recites the step of depositing comprises reducing the deposition component at a cathodic site. As stated above, page 6, line 15 of the specification indicates that the present invention uses galvanic coating and a displacement reaction. As explained at page 14 of the specification the less noble constituent serves as a reducing agent for the more noble constituent which is reduced. As indicated at page 15, lines 1-3 of the specification, the oxidation and reduction can each be written as a half-cell reaction. The deposition of claim 1 would necessarily involve an oxidation of the less active substrate and a reduction of the more noble deposition component. Consequently, the features of claims 39 and 47 are present in the process of claim 1 and these claims are not considered to further limit the scope of claim 1.

18. Claim 42 recites the further step of loading the organic solution with the desired deposition component. It is not apparent how the process of claim 1 can be carried out if the organic solution does



not contain the deposition component. Thus, it appears that the step recited in claim 42 is necessarily present in the process of claim 1 and that claim 42 does not further limit claim 1.

*Claim Rejections - 35 USC § 102*

19. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

20. Claims 1-6, 9, 10, 13-18, 39, 42, and 47-52 are rejected under 35 U.S.C. 102(a) as being anticipated by the article “Pd-Cu Co-deposition on TiSiN as seeds for electroless plating” by Jingye Li.

21. The Li article is directed to a deposition process. A workpiece which included a TiSiN barrier layer was provided. The TiSiN barrier layer provided an active substrate. See section 1 “Introduction”. This corresponds to the first step of applicant’s process as recited in instant claim 1. Li discloses that Pd and Cu ions were loaded into an organic solution. The Pd and Cu each constitute a desired deposition component that is more noble than the less noble TiSiN barrier layer. The workpiece was contacted with the organic solution. See section 2 “Experimental”. This corresponds to the second step recited in claim 1. Cu was deposited, and Pd and Cu were co-deposited as seed particles. See section 1 “Introduction” and figures 1-4, 6-13 and 15. This corresponds to the displacing and depositing steps recited in claim 1. All steps recited in claim 1 are present in the process of Li. The process of Li closely relates to Example A at pages 18-19 of applicant’s specification where Pd was deposited on a TiSiN layer.

22. With respect to claim 2, the substrate of Li was a metal-containing compound. With respect to claims 3, 4 and 5, the deposition component of Li was Cu or a mixture of Pd and Cu. With respect to

claims 9 and 10, the substrate of Li comprised a titanium-based material which was TiSiN. With respect to claim 13, the organic solution of Li contained two deposition components. With respect to claims 6 and 14, the substrate comprises a TiSiN barrier layer (see section 1 "Introduction"). With respect to claims 15-17, Li discloses adding  $\text{HBF}_4$  to perform in-process etching. See section 3.2. With respect to claim 18, Li discloses introducing additives such as acetone, HAC, methanol and ethanol. See section 2 "Experimental". With respect to claim 39, the more noble Pd and Cu ions of Li were reduced and deposited. This involves an electrochemical oxidation-reduction reaction which can be represented as two-half cell reactions. With respect to claim 42, as indicated above, Li discloses loading Pd and Cu ions into the organic solution. With respect to claim 47, in the process of Li, the deposition components Pd and Cu are reduced by an electrochemical reaction. For reduction of the Pd and Cu cations to occur, the site would have been cathodic. Claim 47 and 48 relate to the amount of water in the organic solution. Table 1 of Li shows that the composition of the organic solution is 5000ppm Cu in 90% organic and 10% additive. No water is added. Claim 50 is interpreted in accordance with page 12, lines 1-3 of the specification which discloses removing a surface coating of a barrier layer. The pre-etching or in-process etching of Li would have removed a surface coating from the barrier layer. With respect to claim 51, material from the barrier layer would have been displaced. With respect to claim 52, the pre-etching step of Li in section 3.1 corresponds to the treatment of the active substrate as disclosed at pages 17-18 of applicant's specification.

23. Claims 1-6, 9-11, 14, 18, 19, 27, 39, 42, 44, 47, 48 and 50-52 are rejected under 35 U.S.C. 102(b) as being anticipated by the Fang et al article "An Alternative Metallic Seeding Technique for Subsequent Electrochemical Deposition of Copper onto Barrier Metals".

24. The Fang et al article is directed to a process for depositing a seed metal. A Ti, TiN, Ta or TaN barrier film was deposited onto Si or SiO wafer substrates. The deposited film formed an active substrate.

See the “Experiment” section of the article at page 139. This corresponds to the first step of applicant’s claimed process as recited in instant claim 1. Metal films of Cu or Pd seed materials, which allowed subsequent electroless or electrolytic deposition, were deposited from organic solutions based on a displacement plating process. See the abstract. In displacement or immersion plating processes a bath containing more electrochemically noble metal ions is placed in contact with a metallic surface or substrate that is less electrochemically noble. The less noble metal dissolves at the same time as the more noble metal ion deposits on the surface, thereby “displacing” less noble metal on the original surface into solution. In the work described in the article, the immersion displacement reactions were conducted in organic electrolytes. See the “Introduction” section of the article at pages 137-138. The displacement and simultaneous deposition in the organic solution described by Fang et al correspond to the displacing and depositing steps recited in claim 1. All steps recited in claim 1 are present in the process disclosed by Fang et al.

25. With respect to claims 2, 9 and 10, as noted above, the substrate comprises a metal or metal-containing compound (Ti, TiN, Ta or TaN). With respect to claims 3, 4 and 5, Fang discloses the deposition of copper and palladium. With respect to claim 11, Fang et al disclose that metals have been deposited from organic solutions onto substrates such as aluminum, zinc, iron, titanium and gallium arsenide. See page 139, lines 3-6. With respect to claims 6 and 14, Fang et al disclose the use of a nitride barrier layer. With respect to claim 15, Fang et al disclose treating the substrate by etching before seeding. See the last paragraph on p 139. With respect to claim 18, Fang et al discloses adding organic diluents and other organic activators or additives. See the last paragraph on page 139. With respect to claim 19, Fang et al disclose that in metal solvent extraction, sulfuric acid is present in the loaded organic solvent as shown in equation (1) on page 138. With respect to claim 27, in metal solvent extraction, the transfer of cations between the aqueous and organic phase is based on a chemical driving force gradient. Equation (1) shows that the organic solvent functions as a cation exchange reactant. With respect to

claim 39, as noted above, the less noble metal dissolves at the same time as the more noble metal ions deposit on the substrate. This dissolving and depositing are described by two galvanic half-cell reactions. With respect to claim 42, in the "Experiment" section at the last paragraph of page 139, the bath was loaded with either copper or palladium. With respect to claim 44, Table I shows the open-circuit potentials of metal electrodes in various organics at 25°C. This temperature may be considered to be at an ambient level. With respect to claim 47, in the process of Fang, the deposition components Pd and Cu are reduced by an electrochemical reaction. For reduction of the Pd and Cu cations to occur, the site would have been cathodic. With respect to claim 48, Fang et al disclose the inclusion of a 2 vol% aqueous activating addition. See page 139, last paragraph. This falls within the range of less than 5 vol%. Claim 50 is interpreted in accordance with page 12, lines 1-3 of the specification which discloses removing a surface coating of a barrier layer. The preliminary etching of Fang et al would have removed a surface coating from the barrier layer. With respect to claim 51, material from the barrier layer would have been displaced. With respect to claim 52, the preliminary etching step of Fang et al in the last paragraph of page 139 corresponds to the treatment of the active substrate as disclosed at pages 17-18 of applicant's specification.

***Claim Rejections - 35 USC § 103***

26. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

27. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly

owned at the time any inventions covered therein were made absent any evidence to the contrary.

Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(e) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

28. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over the Fang et al article "An Alternative Metallic Seeding Technique for Subsequent Electrochemical Deposition of Copper onto Barrier Metals".

29. Claim 13 recites the organic solution comprises at least two deposition components. As indicated above, Fang et al disclose the deposition of Cu or Pd from an organic solution by immersion plating. In the table of page 140, Fang et al show the open-circuit potential of metals in various organic solvents. As shown, Ag and Cu have similar potentials. Deposition of more than one metal such as Ag and Cu would have been obvious because properties of both would have been obtained.

30. Claim 44 is rejected under 35 U.S.C. 103(a) as being unpatentable over the article "Pd-Cu Co-deposition on TiSiN as seeds for electroless plating" by Jingye Li.

31. Claim 44 recites using temperatures from ambient to elevated. There is no teaching is Li that lowered temperatures should be used. This would suggest to one of ordinary skill in the art that it would be at least obvious to use ambient temperature or temperatures above ambient. The use of ambient would have required less energy because the solution would not have required heating or cooling.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to WILLIAM T. LEADER whose telephone number is (571) 272-1245. The examiner can normally be reached on Mondays-Thursdays and alternate Fridays, 7:30-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Susy Tsang-Foster can be reached on 571-272-1293. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/William Leader/  
August 27, 2008  
/Susy Tsang-Foster/  
Supervisory Patent Examiner, Art Unit 1795